

# MEMS Interface Card

## QUICK START GUIDE

GM-14915118

Rev 4

December 2013

This guide provides the basic information needed to set up and use your new NovAtel® MEMS Interface Card (MIC). For more detailed information on the installation and operation of your MIC, download the [SPAN on OEM6 User Manual](#) from our web site at [www.novatel.com](http://www.novatel.com).

### BOX CONTENTS

In addition to this *Quick Start Guide*, the following is provided with your MIC:

- 1 MIC to IMU interface cable
- 1 IMU mounting PCB (printed circuit board)  
(a PCB is not included with the OEM-IMU-STIM300)
- Screws and standoffs for mounting the MIC

### ADDITIONAL EQUIPMENT REQUIRED

The additional equipment listed below is required for a typical setup:

- An OEM615 receiver



The MIC supports all OEM6® family receiver cards for communications. The OEM615 is the only OEM6 family receiver card that can be directly integrated and powered by the MIC.

- An IMU (see the *IMU Type* column in *Table 1, CONNECTIMU Commands* on page 9)
- A 10-30 VDC power supply

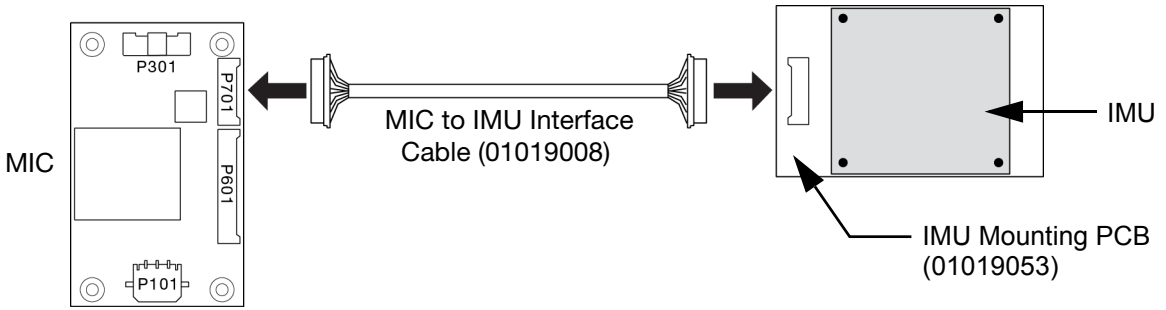


If the MIC is installed in a standalone configuration, a separate power supply is required for the OEM6 family receiver. For information about the power supply requirements, refer to the Technical Specification appendix for the receiver card in the [OEM6 Family Installation and Operation User Manual](#). This user manual is available from our website at [www.novatel.com](http://www.novatel.com).

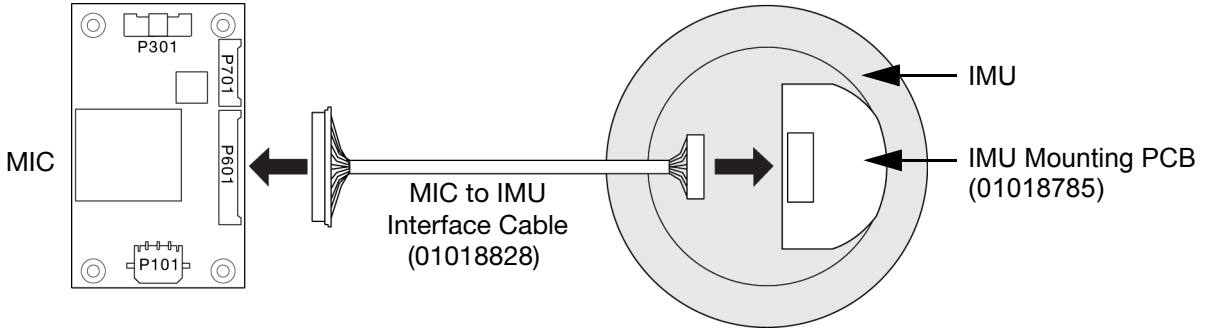
- A wiring harness to provide power to the P101 connector on the MIC (10-30 VDC).
- A wiring harness to connect the customers equipment to the P301 connector on the MIC.
- A quality, dual-frequency GNSS antenna such as the GPS-702-GG. See the NovAtel website ([www.novatel.com/products/gnss-antennas/](http://www.novatel.com/products/gnss-antennas/)) for information on a variety of quality antennas available to meet your form factor and performance needs.
- An antenna cable
- A Windows® based computer

# IMU SETUPS

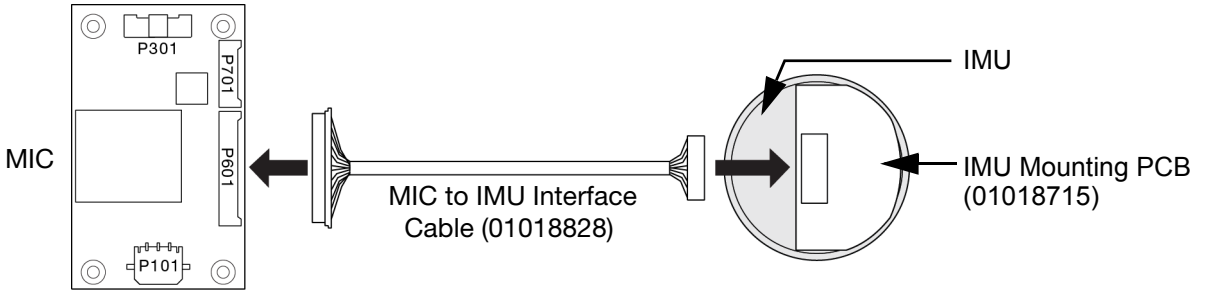
**Figure 1: MIC to OEM-IMU-ADIS-16488 (OEM Cable Kit: 01019007)**



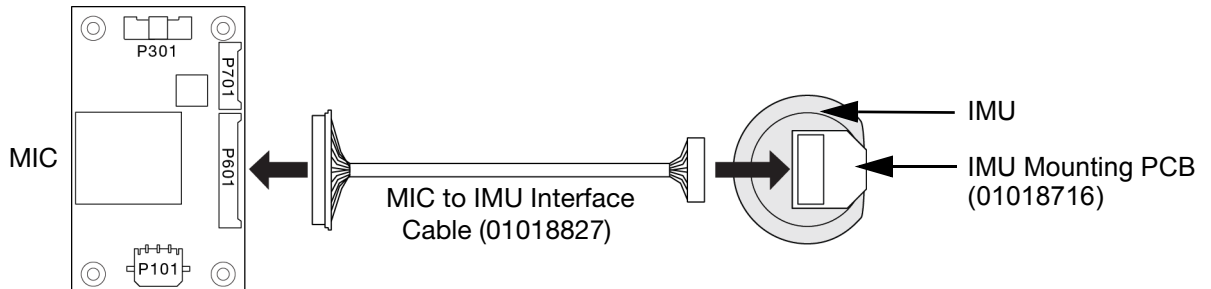
**Figure 2: MIC to OEM-IMU-HG1700 (OEM Cable Kit: 01018868)**



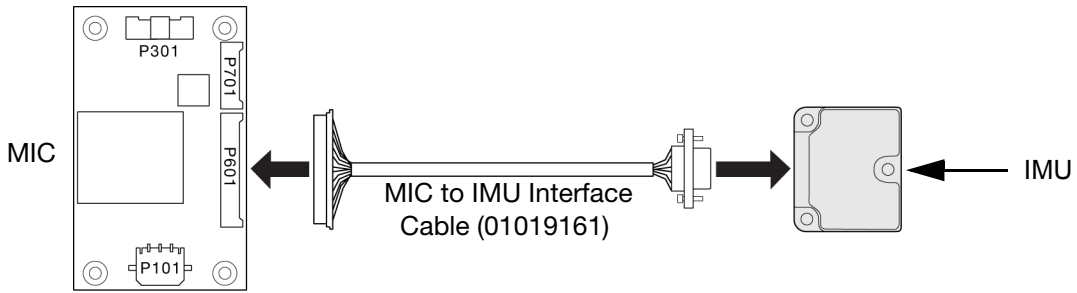
**Figure 3: MIC to OEM-IMU-HG1900 (OEM Cable Kit: 01018871)**



**Figure 4: MIC to OEM-IMU-HG1930 (OEM Cable Kit: 01018869)**

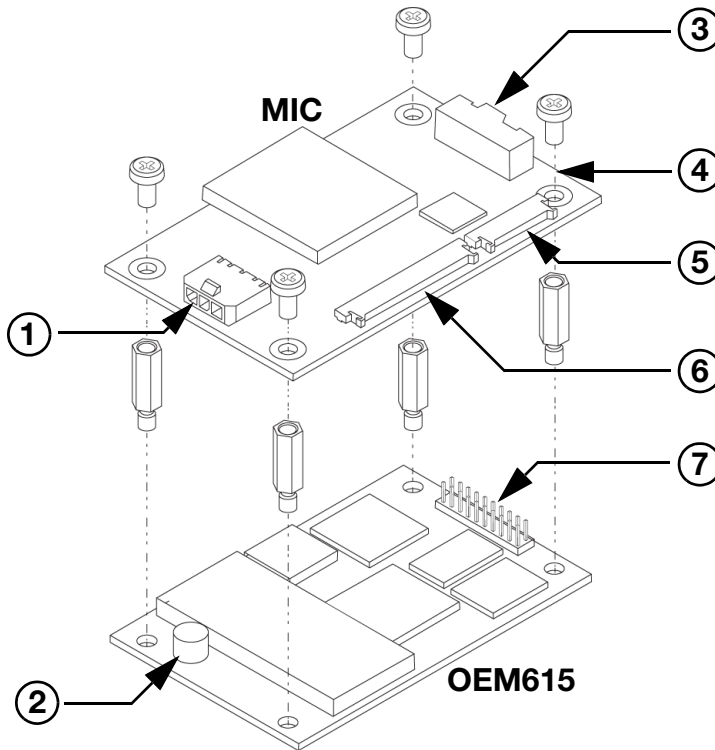


**Figure 5: MIC to OEM-IMU-STIM300 (OEM Cable Kit: 01019174)**



## INSTALL THE MIC IN A STACK UP CONFIGURATION


In a stack up configuration, the MIC is connected directly to an OEM615 receiver. Power and communications connections to the receiver are made through the MIC.



Ref	Connector	Part Number	Mating Connector	Description
1	P101	43650-0313 (Molex)	43645-0300 (Molex)	Connects to the power supply (user supplied cable)
2	J101	MCX-J-P-H-ST-SM1 (Samtec)	M1051-110 (ShinA Telecom)	Connects to the GNSS antenna (user supplied cable)
3	P301	501571-3007 (Molex)	501189-3010 (Molex)	Connects to COM and USB ports LVTTTL (not 5 V tolerant) (user supplied cable)

Ref	Connector	Part Number	Mating Connector	Description
4	J301	ASP-163577-01 (Samtec)	N/A	Connects to the P1101 connector on the OEM615
5	P701	53780-1070 (Molex)	51146-1000 (Molex)	Connects to ADIS IMUs (NovAtel supplied cable)
6	P601	53780-2070 (Molex)	51146-2000 (Molex)	Connects to HG1700, HG1900, HG1930 and STIM300 IMUs (NovAtel supplied cable)
7	P1101	TMM-110-03-G-D (Samtec)	N/A	Connects to the J301 connector on the MIC

Complete the following steps to connect and power your MIC and OEM615.

 Assemble in accordance with applicable industry standards. Ensure all Electrostatic Discharge (ESD) measures are in place, in particular, use a ground strap before exposing or handling any electronic items, including the MIC, receiver and IMU. Take care to prevent damaging or marring painted surfaces, O-rings, sealing surfaces and the IMU.

For more information about ESD practices, see the [OEM6 Family Installation and Operation User Manual](#) available from our website at [www.novatel.com](http://www.novatel.com).

1. Attach the IMU mounting PCB to the IMU.  
Ensure all the pins on the header are aligned with the holes on the mating connector.



An IMU mounting PCB is not used with the STIM300 IMU.

2. Mount the IMU and antenna securely to a vehicle.  
For the simplest operation, align the Y-axis of the IMU with the forward axis (direction of travel) of the vehicle. Ensure the Z-axis is pointing up.  
Ensure that the GNSS antenna and IMU cannot move relative to each other. The distance and relative direction between them must be fixed.



For center of navigation diagrams of the ADIS and STIM300 IMUs, see the [SPAN on OEM6 User Manual](#) available from our web site at [www.novatel.com](http://www.novatel.com).

For center of navigation diagrams of the HG1700, HG1900 and HG1930 IMUs, contact NovAtel Customer Support. See *Questions or Comments* on page 12 for contact information.

3. Use the standoffs supplied with the MIC to mount the OEM615 receiver in a secure enclosure to reduce environmental exposure and RF interference. See the [OEM6 Family Installation and Operation User Manual](#) for information about mounting printed circuit boards.



The part number for the standoffs included with the MIC is RAF-M21073005AL7 (Irwin Industrial).

If alternate standoffs are selected, use equivalent parts with a minimum height of 12 mm.



Ensure all standoffs are properly installed and the mounting location for the receiver is level. The amount of board deflection (bow and twist) must not exceed 0.75%. For example, on the OEM615 which is 71 mm long and 46 mm wide, the deflection along the length must not exceed 0.53 mm and the deflection along the width must not exceed 0.34 mm.

4. Connect the antenna cable to the antenna jack (J101) on the OEM615. The antenna cable must have a right angle MCX connector on the end that connects to the OEM615.

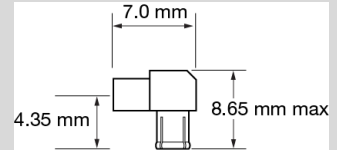


Do not apply power to the cards until the antenna cable is attached.



The part number for the recommended MCX connector is M1051-110 (ShinA Telecom). If an alternate is used part, it should meet the dimensions shown in the diagram.

The space between the OEM615 and the MIC is limited. The height of the MCX connector **must not** exceed 8.65 mm.



5. Align the OEM615 mating connector (J301) on the MIC with the 20-pin header (P1101) on the OEM615. Make sure all of the pins on the header are aligned with the holes in the mating connector. Press down on the MIC to seat the connector on the header.
6. Use the four screws supplied with MIC to secure the MIC to the OEM615.
7. Connect the IMU-to-MIC interface cable to the IMU.
8. Connect the IMU-to-MIC interface cable to the IMU connector on the MIC.
  - Use the 10-pin locking connector (P701) for the ADIS IMU.
  - Use the 20-pin locking connector (P601) for the HG1700, HG1900, HG1930 or STIM300 IMU.
9. Using a customer supplied wiring harness, connect a +10 to +30 V DC power supply to the power connector (P101) on the MIC. This connection provides power to the MIC and the OEM615. See the [SPAN on OEM6 User Manual](#) for pin out information for the power connector.
10. Using a customer supplied wiring harness, connect the communications connector (P301) to the user system.

In a stack up configuration, the P301 connector provides connections for the: MIC serial port, OEM615 serial port (COM2), USB port, Event1 trigger, Event2 trigger, 1 Pulse Per Second (PPS) output, Variable Frequency (VARF) output, Reset Input and Position Valid output.

See the [SPAN on OEM6 User Manual](#) for pin out information for the communications connector.



All signal I/O with the exception of the USB port are at LVTTTL levels.

To connect the MIC to devices that use other signals levels, such as a computer with an RS-232 serial port, an interface circuit that converts to and from LVTTTL must be used.

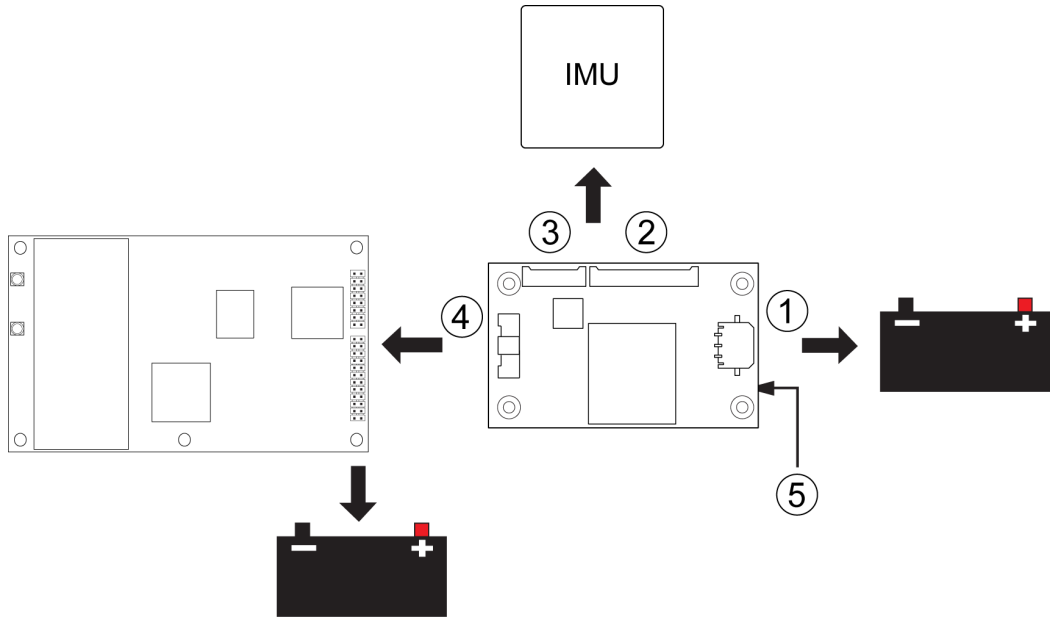


Use a twisted pair for the USB port connection and keep the wires as short as possible.

11. Skip to *Install the PC Utilities* on page 8.

## INSTALL THE MIC IN A STANDALONE CONFIGURATION

In a standalone configuration, the MIC and OEM6 receiver are mounted separately.



Ref	Connector	Part Number	Mating Connector	Description
1	P101	43650-0313 (Molex)	43645-0300 (Molex)	Connects to the MIC power supply (user supplied cable)
2	P601	53780-2070 (Molex)	51146-2000 (Molex)	Connects to HG1700, HG1900, HG1930 and STIM300 IMUs (NovAtel supplied cable)
3	P701	53780-1070 (Molex)	51146-1000 (Molex)	Connects to ADIS IMUs (NovAtel supplied cable)
4	P301	501571-3007 (Molex)	501189-3010 (Molex)	Connects the MIC serial port to the OEM6 receiver (user supplied cable)
5	J301	ASP-163577-01 (Samtec)	N/A	This connector is not used in a standalone configuration.




### OEM628 Recommendations

- Use COM1 for connection to a computer. COM1 uses RS-232 levels and can be connected to a computer without additional interface circuitry.
- Use COM2 for connection to the MIC serial port. Both the MIC serial port and COM2 use LVTTTL levels and can be connected without additional interface circuitry.




### OEM638 Recommendations

- Use COM1 or COM2 for connection to a computer. COM1 and COM2 use RS-232 levels and can be connected to a computer without additional interface circuitry.
- Use COM3 for connection to the MIC serial port. This COM port and the MIC serial port use LVTTTL levels and can be connected without additional interface circuitry.


 For information about the OEM6 receiver card connectors and pin-outs, refer to the *OEM6 Family Installation and Operation User Manual*.

Complete the following steps to connect and power your MIC.


 Assemble in accordance with applicable industry standards. Ensure all Electrostatic Discharge (ESD) measures are in place, in particular, use a ground strap before exposing or handling any electronic items, including the MIC, receiver and IMU. Take care to prevent damaging or marring painted surfaces, O-rings, sealing surfaces and the IMU.

For more information about ESD practices, see the [OEM6 Family Installation and Operation User Manual](#) available from our website at [www.novatel.com](http://www.novatel.com).


1. Attach the IMU mounting PCB to the IMU.  
Ensure all the pins on the header are aligned with the holes on the mating connector.

 An IMU mounting PCB is not used with the STIM300 IMU.

2. Mount the IMU and antenna securely to a vehicle.  
For the simplest operation, align the Y-axis of the IMU with the forward axis (direction of travel) of the vehicle. Ensure the Z-axis is pointing up.  
Ensure that the GNSS antenna and IMU cannot move relative to each other. The distance and relative direction between them must be fixed.

 For center of navigation diagrams of the ADIS and STIM300 IMUs, see the [SPAN on OEM6 User Manual](#) available from our web site at [www.novatel.com](http://www.novatel.com).  
For center of navigation diagrams of the HG1700, HG1900 and HG1930 IMUs, contact NovAtel Customer Support. See *Questions or Comments* on page 12 for contact information.

3. Install the OEM6 receiver in a secure enclosure to reduce environmental exposure and RF interference. See the [OEM6 Family Installation and Operation User Manual](#) for information about installing and connecting an OEM6 receiver.
4. Use the four screws supplied with the MIC to secure the MIC to its mounting location.  
See the [SPAN on OEM6 User Manual](#) for the MIC dimensions.

 Ensure all standoffs are properly installed and the mounting location for the MIC is level.  
The amount of board deflection (bow and twist) must not exceed 0.75%. For example, on the MIC which is 75 mm long and 46 mm wide, the deflection along the length must not exceed 0.56 mm and the deflection along the width must not exceed 0.34 mm.

5. Connect the IMU-to-MIC interface cable to the IMU.
6. Connect the IMU-to-MIC interface cable to the IMU connector on the MIC.
  - Use the 10-pin locking connector (P701) for the ADIS IMU.
  - Use the 20-pin locking connector (P601) for the HG1700, HG1900, HG1930 IMU or STIM300.
7. Using a customer supplied wiring harness, connect a +10 to +30 VDC power supply to the power connector (P101) on the MIC.  
See the [SPAN on OEM6 User Manual](#) for pin out information for the power connector.

8. Using a customer supplied wiring harness, connect a power supply to the OEM6 family receiver. See the [OEM6 Family Installation and Operation User Manual](#) for information about connecting power to an OEM6 family receiver.
9. Using a customer supplied wiring harness, connect the MIC serial port to a serial port on the OEM6 receiver. See the [SPAN on OEM6 User Manual](#) for pin out information for the communications connector.



All signal I/O with the exception of the USB port are at LVTTTL levels.

To connect the MIC to devices that use other signals levels, such as a computer with an RS-232 serial port, an interface circuit that converts to and from LVTTTL must be used.

10. Skip to *Install the PC Utilities on page 8*.

## INSTALL THE PC UTILITIES

1. Install the NovAtel Connect™ PC Utilities and USB drivers.

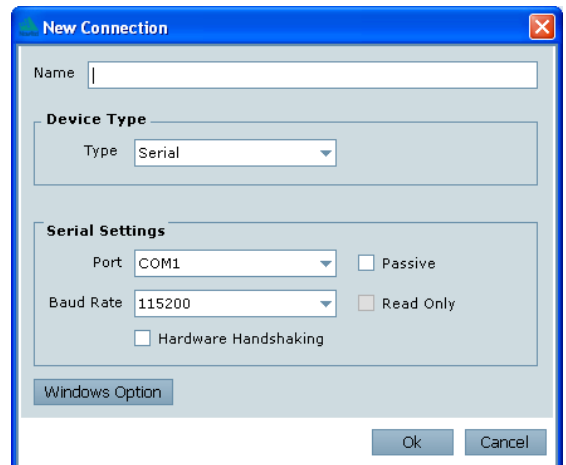
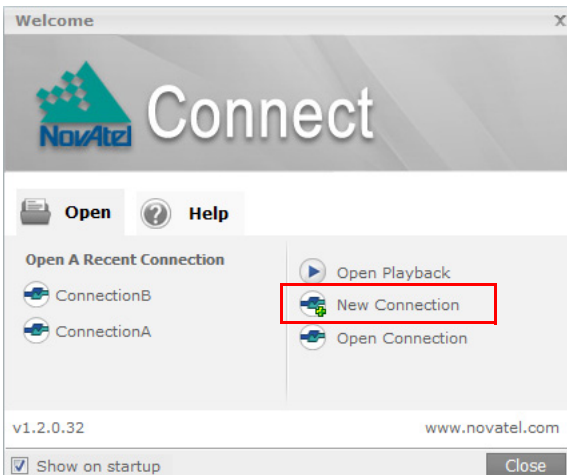


To access and download the most current version of the NovAtel Connect PC Utilities and USB drivers, go to the *Support* page of the NovAtel web site at [www.novatel.com/support/firmware-software-and-manuals/](http://www.novatel.com/support/firmware-software-and-manuals/).

## Establishing a New Receiver Connection

The first time you open a serial port to communicate with the receiver, complete the following:


1. Launch NovAtel Connect from the **Start** menu folder specified during the installation process. The default location is Start | All Programs | NovAtel Connect | NovAtel Connect.
2. Select **New Connection** from the Welcome window.



3. Enter a name for the Connection.
4. Select **Serial** or **USB** from the **Type** list.
5. Select the computer port that the SPAN system is connected to from the Port drop down list.



6. If this is a serial connection, select **115200** from the **Baud Rate** drop down list.
7. If this is a serial connection, clear the **Use hardware handshaking** check box.
8. Click the **OK** button to save the new connection.
9. Select the SPAN receiver from the Available Device Connections area of the Open Connection window.
10. Click the **Open** button to open SPAN receiver communications.
11. As NovAtel Connect establishes the communication session with the receiver, a progress box is displayed.

 Detailed instructions for using NovAtel Connect are available from within the utility Help or the .chm file bundled with the software.

## CONFIGURE THE SPAN<sup>®</sup> SYSTEM

Follow these steps to enable INS as part of the SPAN system using software commands:

1. Establish a connection to the OEM6 receiver.  
Refer to the receiver Quick Start Guide for information about connecting to the receiver and entering commands.

 A GNSS antenna must be connected and tracking satellites for operation.

2. Issue the `CONNECTIMU` command to specify the type of IMU and the receiver port connected to the IMU (see *Table 1*).

**Table 1: CONNECTIMU Commands**

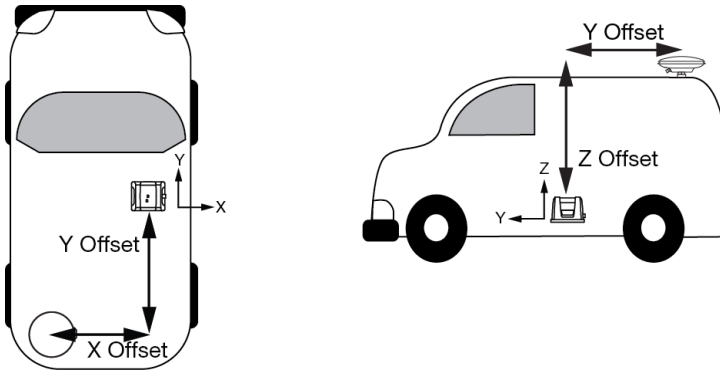
IMU Type	CONNECTIMU command
ADIS-16488	CONNECTIMU COMx <sup>a</sup> IMU_ADIS16488
HG1700 AG11	CONNECTIMU COMx <sup>a</sup> IMU_HG1700_AG11
HG1700 AG17	CONNECTIMU COMx <sup>a</sup> IMU_HG1700_AG17
HG1700 AG58	CONNECTIMU COMx <sup>a</sup> IMU_HG1700_AG58
HG1700 AG62	CONNECTIMU COMx <sup>a</sup> IMU_HG1700_AG62
HG1900 CA50	CONNECTIMU COMx <sup>a</sup> IMU_HG1900_CA50
HG1930 CA50	CONNECTIMU COMx <sup>a</sup> IMU_HG1930_CA50
STIM300	CONNECTIMU COMx <sup>a</sup> IMU_STIM300

a. If you are using the OEM615+MIC board stack, you must use COM1.

Basic configuration of the SPAN system is now complete. The inertial filter starts once the GNSS solution is solved and the IMU is connected.

- Enter the distance from the IMU to the GNSS antenna using the SETIMUTOANTOFFSET command. The X (pitch), Y (roll) and Z (azimuth) directions are clearly marked on the IMU enclosure. The SETIMUTOANTOFFSET parameters are (where the standard deviation fields are optional):

x\_offset y\_offset z\_offset [x\_stdev] [y\_stdev] [z\_stdev]



This example assumes a default mounting configuration with a -X offset, -Y offset and +Z offset.

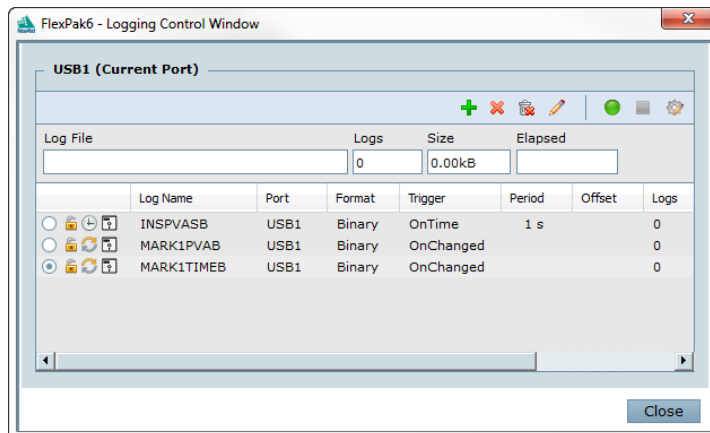
A typical RTK GNSS solution is accurate to a few centimetres. For the integrated GNSS/INS system to have this level of accuracy, the offset must be measured to within a centimetre.

- Perform a kinematic alignment.  
See the [SPAN on OEM6 User Manual](#) for more information.

## LOG SPAN DATA

Navigation data (position, velocity, attitude) is available from the system as ASCII or binary logs.

Data can be collected through NovAtel Connect using the *Logging Control Window*, or sent out the receiver COM port to user supplied data collection software.



The figure shows the recommended logs for optimal real-time performance.

## OPERATE THE SPAN SYSTEM

The system is ready to go once it is powered and the INS and GNSS are configured using the previously shown commands.

Observe the status of the system in the NovAtel Connect *INS Window* or in the status field of any of the INS solution logs (for example INSPOS, INSVEL, INSATT and INSPVA).



INS data is available once there is a good GNSS solution. Therefore, an antenna must be connected for the system to function.

If performing a static alignment, allow the system to be stationary for at least 1 minute after the GNSS solution is computed for its initial system alignment. If performing a kinematic alignment, move the vehicle forward at a speed faster than 5 m/s. The following status stages may be observed:

**Table 2: Inertial Solution Status**

Binary	ASCII	Description
0	INS_INACTIVE	IMU logs are present, but the alignment routine has not started; INS is inactive.
1	INS_ALIGNING	INS is in alignment mode.
2	INS_HIGH_VARIANCE	The INS solution is still being computed but the azimuth solution uncertainty has exceed 2 degrees. The solution is still valid but you should monitor the solution uncertainty in the INSCOV log. You may encounter this state during times when the GNSS, used to aid the INS, is absent.
3	INS_SOLUTION_GOOD	The INS filter is in navigation mode and the INS solution is good.
6	INS_SOLUTION_FREE	The INS filter is in navigation mode and the GNSS solution is suspected to be in error. This may be due to multipath or limited satellite visibility. The inertial filter has rejected the GNSS position and is waiting for the solution quality to improve.
7	INS_ALIGNMENT_COMPLETE	The INS filter is in navigation mode, but not enough vehicle dynamics have been experienced for the system to be within specifications.
8	DETERMINING_ORIENTATION	INS is determining the IMU axis aligned with gravity.
9	WAITING_INITIALPOS	The INS filter has determined the IMU orientation and is awaiting an initial position estimate to begin the alignment process.

## POST-PROCESS DATA

Post-processing requires collection of simultaneous data from the base and rover stations. This includes accurate coordinates of the base station and accurate measurement of the IMU to antenna separation.

Collect the following data for post-processing:

- From the base station
  - RANGECMPB ontime 1
  - RAWEPHEMB onchanged
  - GLOEPHEMERISB onchanged (if using GLONASS)
- From the rover station(s)
  - RANGECMPB ontime 1
  - RAWEPHEMB onchanged
  - GLOEPHEMERISB onchanged (if using GLONASS)
  - RAWIMUSXB onnew
  - IMUTOANTOFFSETSB onchanged
  - VEHICLEBODYROTATIONB onchanged

SPAN system output is compatible with Inertial Explorer® post-processing software from the Waypoint® Products Group, NovAtel Inc. Visit our website at [www.novatel.com/products/software/](http://www.novatel.com/products/software/) for details.

## QUESTIONS OR COMMENTS

If you have any questions or comments regarding your SPAN system, contact NovAtel Customer Service by:

Email: [support@novatel.com](mailto:support@novatel.com)

Web: [www.novatel.com](http://www.novatel.com)

Phone: 1-800-NOVATEL (U.S. & Canada)  
1-800-668-2835

1-403-295-4500 (International)

Fax: 1-403-295-4501



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